

## Description

The SF-S16 is small form factor pluggable module for bi-directional serial optical data communications such as SONET OC-3 / SDH STM-1 and Fast Ethernet. It is with the SFP 20-pin connector to allow hot plug capability. Digital diagnostic functions are available via an I2C. This module is designed for single mode fiber and operates at a nominal wavelength of 1550 nm. A guaranteed minimum optical link budget of 37 dB is offered which can correspond to a link distance of over 160 km (assuming worst case fiber loss of 0.2 dB/km). The transmitter section uses a 1550 nm multiple quantum well DFB laser and is a class 1 laser compliant according to International Safety Standard IEC-60825. The receiver section uses an integrated InGaAs detector preamplifier (IDP) mounted in an optical header and a limiting post-amplifier IC.



## Features

- Small Form Factor Pluggable MSA Compliant
- Compliant with SONET OC-3 / SDH STM-1
- 37 dB Power Budget (up to 160 km)
- 1550 nm DFB LD Transmitter
- APD High Sensitivity Receiver
- SFF-8472 Digital Diagnostic Function
- EEPROM with serial ID functionality
- LC Duplex Connector
- Class 1 Laser Safety Standard IEC 825 Compliant
- Single + 3.3 V power Supply
- Temperature Ranges: 0 to +70°C
- RoHS Compliant

## Laser Safety

This single mode transceiver is a Class 1 laser product. It complies with IEC-60825 and FDA 21 CFR 1040.10 and 1040.11. The transceiver must be operated within the specified temperature and voltage limits. The optical ports of the module shall be terminated with an optical connector or with a dust plug.

## Applications

- Fast Ethernet Links
- SONET/SDH Equipment Interconnect
- Bridges/Routers/intelligent hub and concentrators

| Absolute Maximum Ratings             |                 |      |         |     |       |
|--------------------------------------|-----------------|------|---------|-----|-------|
| Parameter                            | Symbol          | Min  | Typ     | Max | Unit  |
| Storage Temperature                  | T <sub>S</sub>  | -40  | -       | 85  | °C    |
| Operating Temperature                | T <sub>OP</sub> | 0    | -       | 70  | °C    |
| Power Supply Voltage                 | V <sub>CC</sub> | -0.5 | -       | 3.6 | V     |
| Power Supply Current                 | I <sub>CC</sub> | -    | 200     | 300 | mA    |
| General Specifications               |                 |      |         |     |       |
| Parameter                            | Symbol          | Min  | Typ     | Max | Units |
| Data Rate                            | B               | -    | 125/155 | -   | Mbps  |
| Supported Link Length on 9/125μm SMF | L               | -    | 160     | -   | Km    |

## Order Information

| Models   | Bit Rate (Mbps) | Distance (km) | Wavelength (nm) | Fiber Single/Dual | Package         | Temp. (°C) | TX Power (dBm) | RX Sens. (dBm) |
|----------|-----------------|---------------|-----------------|-------------------|-----------------|------------|----------------|----------------|
| SF-S16   | 125 / 155       | 160           | 1550 DFB        | Dual              | LC SFP w/o DMI  | 0 to70     | 5 to 2         | -35            |
| SF-S16-D | 125 / 155       | 160           | 1550 DFB        | Dual              | LC SFP with DMI | 0 to70     | 5 to 2         | -35            |

| Transmitter Specifications (0°C < Topr < 70°C, 3.135V < Vcc < 3.465V) |  |      |     |                      |       |                    |
|---|--|------|-----|----------------------|-------|--------------------|
| Parameter   | Symbol   | Min  | Typ | Max                  | Units | Notes              |
| <b>Optical</b>  |  |      |     |                      |       |                    |
| Optical Transmit Power  | P <sub>o</sub>   | 2    | --- | 5                    | dBm   | 1                  |
| Output Center Wavelength  | λ  | 1480 |     | 1580                 | nm    |                    |
| Output Spectrum Width   | Δλ   | ---  | --- | 1                    | nm    | -20 dB Width       |
| Side Mode Suppression Ratio   | SMSR   | 30   |     |                      | dB    |                    |
| Extinction Ratio  | E <sub>R</sub>   | 10   | --- | ---                  | dB    |                    |
| Output Eye  | Compliant with Bellcore TR-NWT-000253 and ITU recommendation G.957 |      |     |                      |       |                    |
| Optical Rise Time   | t <sub>r</sub>   |      |     | 2                    | ns    | 10 % to 90% Values |
| Optical Fall Time   | t <sub>f</sub>   |      |     | 2                    | ns    | 10 % to 90% Values |
| Relative Intensity Noise  | RIN  |      |     | -120                 | dB/Hz |                    |
| <b>Electrical</b>   |  |      |     |                      |       |                    |
| Data Input Current – Low  | I <sub>IL</sub>  | -350 |     |                      | μA    |                    |
| Data Input Current – High   | I <sub>IH</sub>  |      |     | 350                  | μA    |                    |
| Differential Input Voltage  | V <sub>IH</sub> - V <sub>IL</sub>                                  | 0.5  |     | 2.4                  | V     | Peak-to-Peak       |
| TX Disable Input Voltage – Low  | T <sub>DIS,L</sub>   | 0    |     | 0.5                  | V     | 2                  |
| TX Disable Input Voltage – High                                       | T <sub>DIS,H</sub>   | 2.0  |     | V <sub>cc</sub>      | V     | 2                  |
| TX Disable Assert Time  | T <sub>ASSERT</sub>  |      |     | 10                   | μs    |                    |
| TX Disable Deassert Time  | T <sub>DEASSERT</sub>  |      |     | 1                    | ms    |                    |
| TX Fault Output Voltage -- Low  | T <sub>FAULTL</sub>  | 0    |     | 0.8                  | V     | 3                  |
| TX Fault Output Voltage -- High                                       | T <sub>FAULTH</sub>  | 2.0  |     | V <sub>cc</sub> +0.3 | V     | 3                  |

- Output power is power coupled into a 9/125 μm single mode fiber.
- There is an internal 4.7K to 10K ohm pull-up resistor to VccTX.
- Open collector compatible, 4.7K to 10K ohm pull-up to Vcc (Host Supply Voltage).

| Receiver Specifications (0°C < Topr < 70°C, 3.135V < Vcc < 3.465V) |                                   |      |     |                      |       |                         |
|--|-----------------------------------|------|-----|----------------------|-------|-------------------------|
| Parameter  | Symbol                            | Min  | Typ | Max                  | Units | Notes                   |
| <b>Optical</b>   |                                   |      |     |                      |       |                         |
| Sensitivity  | Sens                              |      |     | -35                  | dBm   | 4                       |
| Maximum Input Power  | P <sub>in</sub>                   | -8   |     |                      | dBm   | 4                       |
| Signal Detect -- Asserted  | P <sub>a</sub>                    | ---  |     | -35                  | dBm   | Transition: low to high |
| Signal Detect -- Deasserted  | P <sub>d</sub>                    | -47  | --- | ---                  | dBm   | Transition: high to low |
| Signal detect -- Hysteresis  |                                   | 1.0  | --- |                      | dB    |                         |
| Wavelength of Operation  |                                   | 1200 | --- | 1600                 | nm    |                         |
| <b>Electrical</b>  |                                   |      |     |                      |       |                         |
| Differential Output Voltage  | V <sub>OH</sub> - V <sub>OL</sub> | 0.6  |     | 2.0                  | V     |                         |
| Output LOS Voltage -- Low  | V <sub>OL</sub>                   | 0    |     | 0.8                  | V     | 5                       |
| Output LOS Voltage -- High   | V <sub>OH</sub>                   | 2.0  |     | V <sub>cc</sub> +0.3 | V     | 5                       |

- Measured at 2<sup>23</sup>-1 PRBS at BER 1E-10.

